J. W. Bongberg RMO

J. W. BONGBERG

UNITED STATES DEPARTMENT OF AGRICULTURE

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EFFECTIVENESS OF SANITATION-SALVAGE LOGGING IN REDUCING INSECT-CAUSED LOSS

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J. W. Bongberg
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EFFECTIVENESS OF SANITATION-SALVAGE LOGGING IN REDUCING INSECT-CAUSED LOSS

BLACK'S MOUNTAIN EXPERIMENTAL FOREST
SEASON 1940

APPROVED BY:

J. M. MILLER
SENIOR ENTOMOLOGIST, IN CHARGE

SUBMITTED BY:

J. W. BONGBERG
ASSISTANT ENTOMOLOGIST

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INTRODUCTION

THE 1940 FIELD SEASON COMPLETED THE FOURTH SUCCESSIVE YEAR OF COOPERATION BETWEEN THE CALIFORNIA FOREST AND RANGE EXPERIMENT STATION AND THE BERKELEY FOREST INSECT LABORATORY, BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE, ON THE SUSTAINED YIELD EXPERIMENT IN PINE ON THE BLACK'S MOUNTAIN EXPERIMENTAL FOREST (3).

A PART OF THE EXPERIMENTAL PROGRAM WHICH HAS THUS FAR BEEN MAINTAINED BY THE BUREAU IS CONCERNED WITH THE TESTING OF AN APPLICATION OF SANITATION-SALVAGE LOGGING AS AN INDIRECT INSECT CONTROL MEASURE TO DETERMINE TO WHAT DEGREE SUBSEQUENT INFESTATIONS AND LOSS HAVE BEEN REDUCED AS A RESULT OF THE LIGHT TREATMENT. ALTHOUGH OTHER STUDIES ARE ALSO INVOLVED IN THE BUREAU PROGRAM AT BLACK'S MOUNTAIN, THIS PAPER WILL BE CONFINED TO A REPORT OF THE RESULTS WHICH HAVE BEEN SECURED TO DATE IN ANSWER TO THE FOLLOWING TWO OBJECTIVES.

OBJECTIVES IN SANITATION-SALVAGE CUTTING

1. WILL THE REMOVAL OF HIGH RISK TREES IN A SANITATION-SALVAGE CUT MATERIALLY REDUCE SUBSEQUENT LOSS RESULTING FROM ENDEMIC INFESTATIONS?

2. WILL THE REMOVAL OF HIGH RISK TREES FROM THE STAND HELP PREVENT THE OCCURRENCE OF CONDITIONS CONTRIBUTING TO THE BUILD UP OF HEAVY WESTERN PINE BEETLE POPULATIONS?

APPLICATION OF SANITATION-SALVAGE TREATMENT

THE APPLICATION OF SANITATION-SALVAGE CUTTING FOR THE REMOVAL OF HIGH RISK TREES AS A MEASURE TO REDUCE INSECT-CAUSED LOSS WAS FIRST EMPLOYED ON THE EXPERIMENTAL AREA IN 1937. DURING THAT SEASON 243 ACRES WERE CUT. IN THE FOLLOWING THREE YEARS, AN ADDITIONAL 1,320 ACRES HAVE BEEN TREATED BY THE LIGHT SELECTIVE CUTTING. THREE COMPLETE SEASONS OF LOSS SUBSEQUENT TO THE FIRST YEAR'S CUTTING IS THE EXTENT OF THE RECORD NOW AVAILABLE FOR USE IN INDICATING THE PERIOD OF PROTECTION SECURED BY THE LIGHT LOGGING TREATMENT. THIS RECORD IS BASED ONLY FROM THE 243 ACRES CUT IN 1937. HOWEVER, ESTIMATES OF REDUCTION IN LOSS WHICH HAVE BEEN SECURED FROM THE CUTTINGS IN 1938, 1939, AND EARLY 1940 ARE AVAILABLE TO BOLSTER PREVIOUS RESULTS OBTAINED FOR LESS THAN A THREE YEAR PERIOD, BY FURNISHING LARGER ACREAGES FROM WHICH TO DRAW TENTATIVE CONCLUSIONS.

INFESTATION CONDITIONS AND LOSS REDUCTION

By comparing the loss conditions on treated and untreated areas following the sanitation-salvage treatment, an estimate can be made of the percent in which infestations have been reduced as a result of the light cutting. In previous progress reports (1), the comparison of loss on comparable treated and untreated areas was limited to the acreage where the total green stand volume had been obtained. As a result of additional areas where appraisals of risk have been made it is now possible to use an expanded acreage for the comparison of loss conditions to the areas treated in the sanitation-salvage program.

Four separate comparisons are now possible for arriving at an estimate of the mean and range of reduction in loss the first year following the sanitation-salvage treatment, i.e., losses for the first year on each area treated in the seasonal program can be compared with conditions during that same season on comparable check areas.

In comparing the 1938 loss on the 243 acres treated in 1937 with conditions during the same year on 1,362 acres of check compartments, it was found that there was 77 percent less loss on the treated areas. The 1939 infestation on 209 acres cut in 1938 averaged but 21 board feet per acre, whereas 131 board feet per acre loss occurred on the untreated acreage during the same period. In percent of total stand volume, losses were reduced that year by 80 percent. In 1940, loss trends on untreated areas showed a 70 percent increase over the previous year. By comparing these conditions to the 371 acres cut in 1939, it is shown that a reduction in loss of 92 percent occurred as a result of the light treatment. Early in 1940, 662 acres were cut. Through October of 1940, no loss occurred on the treated acreage, whereas the current summer and winter infestation on a comparable uncut area of 751 acres amounted to 0.77 percent of the total stand volume. From this latest cutting thus far, loss reduction is estimated at 100 percent.

From the comparison of loss conditions during these four separate seasons on cut and uncut areas, the reduction in loss as a result of the light treatment has ranged from 77-100 percent. An average for the one year period is estimated at 90.6 percent. A comparison of green stand and infestation conditions on treated and untreated areas for a one year period on all areas where records are available is given in Table 1.

TABLE 1

COMPARISON OF INSECT LOSSES ON TREATED AND UNTREATED AREAS (ONE YEAR PERIOD)

YEAR	AREA	ACREAGE IN SAMPLE	GREEN STAND TOTAL TREES	GREEN STAND TOTAL MBM VOL.	INSECT-CAUSED LOSS TOTAL TREES	INSECT-CAUSED LOSS TOTAL VOLUME	VOL. /AC.	% STAND VOLUME	ESTIMATED LOSS REDUCTION
	UNCUT	1,362.0	22,087	21,868	56	95,268	70	.44	
1937	CUT	322.0	6,052	4,934	8	4,952	15	.10	77.3%
	UNCUT	941.5	18,514	15,154	98	127,059	135	.84	
1938	CUT	209.4	3,642	2,582	6	4,386	21	.17	79.8%
	UNCUT	1,117.8	16,532	16,829	74	108,095	97	.64	
1939	CUT	371.2	6,627	5,762	3	2,831	8	.05	92.2%
	UNCUT	750.8	10,224	10,846	56	83,667	111	.77	
1940	CUT*	661.5	8,581	7,975	-	-	-	-	100.0%
	UNCUT	4,172.1	67,357	64,698	284	414,089			
TOTAL	CUT	1,563.4	24,872	21,253	17	12,169			
	UNCUT						99	.64	
AVER.	CUT						8	.06	90.6%

* CUTTING DURING MAY, JUNE, AND EARLY JULY.

AN ACCUMULATION OF LOSS RECORDS FOR TWO CONSECUTIVE YEARS FOLLOWING EACH SEASONAL TREATMENT HAS BEEN SECURED ONLY FROM THE AREAS CUT IN 1937, 1938, AND 1939. A TWO YEAR APPRAISAL OF THE EFFECTS SECURED FROM THE 1937 CUT INDICATED A LOSS REDUCTION OF 68 PERCENT. FROM A COMPARISON OF LOSSES ON TREATED AND UNTREATED AREAS FOR TWO YEARS SUBSEQUENT TO THE 1938 TREATMENT, REDUCTION IN LOSS WAS ESTIMATED AT 84 PERCENT. THE EARLY 1939 CUTTINGS RESULTED IN A TWO YEAR LOSS REDUCTION OF 88 PERCENT. A COMPARISON OF RECORDS ON CUT AND UNCUT PLOTS FOR TWO YEARS FOLLOWING EACH SEASONAL LOGGING TREATMENT IS GIVEN IN TABLE 2.

TABLE 2

COMPARISON OF INSECT LOSSES ON TREATED AND UNTREATED AREAS (TWO YEAR PERIOD)

YEAR	AREA	ACREAGE IN SAMPLE	GREEN STAND TOTAL TREES	GREEN STAND TOTAL MBM VOL.	INSECT-CAUSED LOSS TOTAL TREES	INSECT-CAUSED LOSS TOTAL VOLUME	VOL. /AC.	% STAND VOLUME	ESTIMATED LOSS REDUCTION
	UNCUT	1,054.3	15,942	16,245	112	170,125	161	1.05	
1937	CUT	322.0	6,052	4,934	19	16,758	52	.34	67.6%
	UNCUT	941.5	18,514	15,154	198	258,578	275	1.71	
1938	CUT	209.4	3,612	2,582	10	7,073	34	.27	84.2%
	UNCUT	579.7	8,934	9,171	82	111,116	192	1.21	
1939	CUT	371.2	4,627	5,762	6	8,323	22	.14	88.4%
	UNCUT	2,575.5	43,390	40,570	392	539,819			
TOTAL	CUT	901.9	14,291	13,279	35	32,154			
	UNCUT						210	1.33	
AVER.	CUT						36	.24	82.0%

AN ESTIMATE OF LOSS REDUCTION FOR THREE YEARS CAN BE MADE ONLY FROM THE AREA TREATED IN 1937. THE TOTAL RECORD OF LOSS ON CUT AND UNCUT COMPARTMENTS FOR THIS PERIOD IS GIVEN IN TABLE 3. SINCE THE EFFECTIVENESS OF THE 1937 TREATMENT HAS BEEN LOWER THAN THAT SECURED FROM THE OTHER ONE AND TWO YEAR COMPARISONS, THE ESTIMATE OF REDUCTION IN LOSS AS GIVEN IN TABLE 3 IS EXPECTED TO BE BELOW AVERAGES WHICH WILL BE OBTAINED WHEN AN APPRAISAL CAN BE MADE FOR THE LATER CUTTINGS.

TABLE 3

COMPARISON OF INSECT LOSSES ON TREATED AND UNTREATED AREAS (THREE YEAR PERIOD)

YEAR	AREA	ACREAGE IN SAMPOE	GREEN STAND TOTAL TREES	GREEN STAND TOTAL MBM VOL.	INSECT-CAUSED LOSS TOTAL TREES	INSECT-CAUSED LOSS TOTAL VOLUME	VOL. /AC.	% STAND VOLUME	ESTIMATED LOSS REDUCTION
	UNCUT	579.7	8,965	9,210	104	140,805	243	1.53	
1937	CUT	322.0	6,052	4,934	23	21,241	66	.43	71.9%

THE SINGLE CONCLUSION WHICH CAN BE DRAWN CONCERNING THE EFFECTIVENESS OF THE SANITATION-SALVAGE TREATMENT IN REDUCING SUBSEQUENT LOSS IS THAT THE METHOD SHOWS CONSIDERABLE PROMISE AS A MEANS OF CONTROLLING THE INFESTATIONS ENCOUNTERED ON THE EXPERIMENTAL AREA. BECAUSE OF THE SHORT PERIOD IN WHICH RECORDS HAVE BEEN TAKEN, THE TENTATIVE CONCLUSION MADE FROM THE STUDY THUS FAR MAY OR MAY NOT INDICATE THE FINAL RESULTS WHICH WILL BE OBTAINED WHEN THE EXPERIMENTAL PROGRAM IS COMPLETED.

EFFECT OF SANITATION-SALVAGE LOGGING IN PREVENTION OF EPIDEMIC LOSS

EPIDEMIC INFESTATIONS WILL HAVE TO OCCUR ON UNTREATED AREAS BEFORE AN ADEQUATE APPRAISAL CAN BE MADE CONCERNING SANITATION-SALVAGE TREATMENT AS A MEANS OF PREVENTING THE OCCURRENCE OF HEAVY LOSS.

THE 1940 INFESTATION ON VIRGIN AREAS SHOWED SOME INDICATIONS THAT CONDITIONS WERE APPROACHING EPIDEMIC PROPORTIONS (2). THERE WAS A FREQUENT OCCURRENCE OF LOSS IN SMALL GROUPS OF FROM THREE TO SEVEN TREES OVER MUCH OF THE UNTREATED AREA. IN CONTRAST TO THESE INFESTATION CONDITIONS ON VIRGIN AREAS, TREATED COMPARTMENTS WERE PRACTICALLY VOID OF GROUP LOSS. OCCASIONALLY A PAIR OF INFESTED TREES WERE ENCOUNTERED ON TREATED AREAS. ONLY A SINGLE "GROUP KILL" OF BUT THREE TREES HAS THUS FAR BEEN FOUND AND THIS ONE GROUP OCCURRED DURING 1940 ON THE FIRST COMPARTMENT AREA TREATED BY THE SANITATION-SALVAGE CUT IN 1937.

THE ABSENCE OF AN EPIDEMIC TYPE OF LOSS ON THE TREATED AREAS MAY INDICATE THAT THE TREATMENT HAS OVERBALANCED SOME OF THE CONDITIONS WHICH ARE CONTRIBUTING TO THE BUILD UP OF HEAVY PINE BEETLE POPULATIONS. THUS FAR, THEN, IT MAY BE TENTATIVELY CONCLUDED THAT THE REMOVAL OF HIGH RISK TREES FROM THE STAND DOES HELP PREVENT THE OCCURRENCE OF CONDITIONS LEADING TO EPIDEMIC LOSS.

THE EFFECT WHICH SANITATION-SALVAGE TREATMENT HAS HAD IN REDUCING LOSS IS EXPRESSED IN PERCENT OF LOSS REDUCTION ON TREATED AREAS. THE INCREASED EFFICIENCY OF THE TREATMENT THAT HAS OCCURRED DURING EACH SEASON INDICATES THAT THE UPSWING IN LOSS TRENDS ON VIRGIN AREAS SINCE 1937 HAS NOT HAD ANY CORRESPONDING TENDENCY ON THE TREATED AREAS. PROVIDING CYCLICAL TENDENCIES DO EXIST IN WESTERN PINE BEETLE INFESTATIONS (4), AND THE SANITATION-SALVAGE TREATMENT CONTINUES TO RESULT IN A SATISFACTORY REDUCTION OF SUBSEQUENT LOSS, THERE IS EVERY REASON TO BELIEVE THAT FOLLOWING THE PEAK INFESTATION ON VIRGIN AREAS, LOSSES ON TREATED COMPARTMENTS DURING THE DOWNWARD TREND OF THE INFESTATION WILL CONTINUE TO BE LESS. SHOULD THIS CONDITION PROVE ITSELF, IT COULD BE CONCLUDED THAT UNDER SIMILAR CIRCUMSTANCES, AND IN THIS AREA, THE SANITATION-SALVAGE TREATMENTWOULD PROVIDE AT LEAST A 10 YEAR PROTECTION AGAINST SUBSEQUENT HEAVY LOSS.

PLANS FOR CONTINUING WORK DURING 1949

It has been decided that during 1941 a limited test will be made of what effect the removal of only risk 4 trees will have in reducing subsequent infestations and loss. The record of loss in the risk group designations shows that a majority of the trees which have been killed thus far had previously been designated as risk 4. This evidence would indicate that by a removal of only risk 4 trees, a majority of all loss might have been prevented. By limiting the sanitation cut to the risk 4 group, only approximately 6 percent of the stand volume would be removed, thereby allowing for a relatively rapid coverage of the uncut area in need of treatment. It is doubtful, of course, whether the removal of only the risk 4 trees would result in a protection to the reserve stand for as long a period as might be secured by taking out both high risk groups. It may be found, as a result of this test, that both high risk groups need to be removed for adequate protection. However, the evidence at present indicates that under endemic infestation conditions, practically all loss occurs only in the very high risk trees. Likewise, we have no conclusive data as yet to indicate that epidemic loss can be prevented on the areas where both high risk groups have been removed, even though the preliminary results are encouraging that this might be so.

An adequate comparison between the two light cuttings may be made through a random selection of compartments which will be treated during 1941. All phases of the project concerned with ratings of risk and loss reduction through sanitation-salvage cutting will be continued during the current season.

SUMMARY

One of the primary objectives in the experimental work being maintained by the Bureau of Entomology and Plant Quarantine at Black's Mountain has been concerned with determining what effect the removal of high risk trees has had in reducing and preventing heavy loss.

Three seasons of loss subsequent to the first application of sanitation-salvage logging as a measure to reduce and prevent subsequent infestations have been obtained for use in a comparison to comparable untreated areas. Shorter records have been secured from cuttings during 1938, 1939, and early 1940. The comparison of loss conditions between treated and untreated areas has shown that as a result of the cutting, losses the first year were reduced by 91 percent. Two years of loss subsequent to the cutting was 82 percent less on the treated area. For the three year period, loss reduction has been estimated at 72 percent. These records of reduction in loss as a result of the light sanitation-salvage treatment shows that this method of control holds considerable promise as a means of controlling the infestations encountered on this experimental area.

FROM THE RECORDS THUS FAR, IT IS INDICATED THAT THE REMOVAL OF HIGH RISK TREES FROM THE STAND SEEMS TO HAVE OVERBALANCED SOME OF THE CONDITIONS CONTRIBUTING TO THE BUILD UP OF HEAVY WESTERN PINE BEETLE POPULATIONS. GROUPING TENDENCIES WHICH WERE ENCOUNTERED IN THE INFESTATION ON VIRGIN AREAS DURING 1939 AND 1940 WERE PRACTICALLY NIL ON THE AREAS WHICH HAD BEEN TREATED BY THE LIGHT CUT. ASIDE FROM AN OCCASIONAL PAIR OF INFESTED TREES, ONLY A SINGLE GROUP OF THREE TREES OCCURRED ON ANY TREATED COMPARTMENT. THIS SINGLE OCCURRENCE OF GROUP LOSS WAS LOCATED ON THE FIRST COMPARTMENT AREA WHICH WAS CUT IN 1937. PROVIDING INFESTATION CONDITIONS DURING THE NEXT FEW YEARS CONTINUE TO BE LESS ON TREATED AREAS, THE SANITATION-SALVAGE TREATMENT SHOULD PROVIDE PROTECTION AGAINST SUBSEQUENT LOSS TO THE REMAINING STAND FOR APPROXIMATELY 10 YEARS.

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